

Amendments to existing claims:

1. (Amended) A programmable controller that performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes; and

a universal microprocessor ~~which mounts~~ including an acceleration ~~mounting~~ unit, such as a pipeline logic and a cache, and ~~which is directly executed by~~ executing the execution codes.

2. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising: a compiler which compiles the control program into codes directly executable by a universal microprocessor that ~~mounts~~ includes an acceleration ~~mounting~~ unit, such as a pipeline logic and a cache.

3. (Amended) The control-program-development supporting apparatus according to claim 2 further comprising: an optimization filtering unit which reconstructs the control program into an optimum code system by excluding not-cited variables and redundant codes and rearranging codes for locally arranging instructions for a common input or output device ~~is included~~, wherein a control program optimized by said optimization filtering unit is newly used as the ~~former~~ control program.

4. (Amended) The control-program-development supporting apparatus according to claim 2, further comprising: a processing-time rough-estimating unit which has a relating table which relates a sample program having ~~the~~ a known processing time ~~already known~~ with the control program corresponding to the execution codes to estimate ~~a~~ sequential-processing execution time of a programmable controller in accordance with the relating table.

5. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising:

a control-program dividing unit which divides the control program into a plurality of blocks; and

a compiler which compiles ~~all or~~ at least some of the blocks into execution codes directly executable by a programmable controller.

6. (Amended) The control-program-development supporting apparatus according to claim 5, wherein the programmable controller ~~is provided with~~ includes a universal microprocessor ~~that mounts~~ having an acceleration ~~mounting~~ unit, such as a pipeline logic and a cache.

7. (Amended) The control-program-development supporting apparatus according to claim 5, wherein the control program is a ladder diagram or an instruction list generated from the ladder diagram, and the control-program dividing unit divides the control program into a plurality of blocks at a predetermined rung in the ladder diagram to generate a program file for every block concerned.

8. (Amended) The control-program-development supporting apparatus according to claim 5, wherein the control program is a ladder diagram or an instruction list generated from the ladder diagram, and the control-program dividing unit divides the control program into a plurality of blocks at a predetermined rung serving as a jump destination for a jump instruction in the ladder diagram to generate a program file for every ~~blocks concerned~~ block.

9. (Amended) The control-program-development supporting apparatus according to claim 5, wherein

the control program is a ladder diagram or an instruction list generated from the ladder diagram, and

the control-program dividing unit extracts ~~all or at least~~ some of rungs including instructions to a common input or output device from the ladder diagram, constitutes one block of ~~all or at least~~ some of the ~~extracted~~ rungs extracted, and generates a program file for every blocks concerned block.

10. (Amended) The control-program-development supporting apparatus according to claim 5 further comprising: an optimization filtering unit which reconstructs the control program into an optimum code system by excluding not-cited variables and redundant codes and rearranging codes for locally arranging instructions for a common input or output device ~~is included~~, wherein a control program optimized by said optimization filtering unit is newly used as the ~~former~~ control program.

11. (Amended) The control-program-development supporting apparatus according to claim 5, further comprising: a processing-time rough-estimating unit which has a relating table which relates a sample program having ~~the~~ a known processing time ~~already known~~ with the control program corresponding to the execution codes to estimate a sequential-processing execution time of a programmable controller in accordance with the relating table.

12. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising:

a control-program dividing unit which divides the control program into a plurality of blocks;

a control-program converting unit which converts ~~all or at least~~ some of the blocks into advanced-language control programs described with a universal-computer-readable advanced language for every blocks concerned block; and

a compiler which compiles ~~all or at least~~ some of universal-computer-readable advanced programming languages corresponding to every above block into codes directly executable ~~codes~~ by a programmable controller.

13. (Amended) The control-program-development supporting apparatus according to claim 12, wherein the programmable controller is provided with a universal microprocessor that ~~mounts~~ includes an acceleration ~~mounting~~ unit, such as a pipeline logic and a cache.

14. (Amended) The control-program-development supporting apparatus according to claim 12, wherein

the control program is a ladder diagram or an instruction list generated from the ladder diagram, and

the control-program dividing unit divides the control program into a plurality of blocks at a predetermined rung in the ladder diagram to generate a program file for every block ~~concerned~~.

15. (Amended) The control-program-development supporting apparatus according to claim 12, wherein the control program is a ladder diagram or an instruction list generated from the ladder diagram, and the control-program dividing unit divides the control program into a plurality of blocks at a predetermined rung, serving as a jump destination for a jump instruction in the ladder diagram, to generate a program file for every ~~blocks concerned~~ block.

16. (Amended) The control-program-development supporting apparatus according to claim 12, wherein

the control program is a ladder diagram or an instruction list generated from the ladder diagram, and

the control-program dividing unit extracts ~~all or~~ at least some of rungs including instructions to a common input or output device from the ladder diagram, ~~constitutes~~ constituting one block of ~~all or~~ at least some of the extracted rungs, and generates a program file for every ~~blocks concerned~~ block.

17. (Amended) The control-program-development supporting apparatus according to claim 12 further comprising: an optimization filtering unit which reconstructs the control program into an optimum code system by excluding not-cited variables and redundant codes and rearranging codes for locally arranging instructions for a common input or output device ~~is included~~, wherein a control program optimized by said optimization filtering unit is newly used as the ~~former~~ control program.

19. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising:

a control-program converting unit which converts the control program into an advanced-programming-language control program described with a universal-computer-readable advanced programming language;

a debugging-code generating unit which generates a debugging control program by inserting a line number ~~concerned~~ into a part corresponding to each line, constituting the instruction list in source codes, constituting the advanced-programming-language control program; and

a debugging executing unit which displays each line of the instruction list and the execution part of the advanced-programming-language control program by relating the former with the latter.

20. (Amended) A programmable controller which performs sequential processing in accordance with execution codes generated by compiling a control program, comprising:

a first storing unit which stores the execution codes;

a second storing unit which stores the data for the difference between an execution code stored in the first storing unit and a new execution code;

a microprocessor ~~to be directly executed by~~ for direct execution of the execution codes; and

a patch processing unit which changes an execution code currently executed to a new execution code at a predetermined timing in accordance with the difference data and continuously executing the changed execution code.

21. (Amended) A programmable controller which performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes; and

a microprocessor ~~to be~~ for directly-executed by executing the execution codes, wherein the execution codes include binary data generated by compressing the control program.

22. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control program, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising:

a compressing unit which compresses the control program to generate a compressed file;

a code converting unit which generates compressed data obtained by converting the compressed file into the code system of the control program; and

a compiling unit which combines the control program with the compressed data and compiles the combined result into codes directly-executable ~~codes~~ by a programmable controller.

23. (Amended) A programmable controller which performs sequential processing in accordance with a control program described with a sequential-control language, such as a ladder diagram or instruction list, said programmable controller comprising:

a storing unit which stores the control program;

an instruction counting unit which counts the appearance frequency of each instruction used for execution of the control program;

a pattern-matching-table generating unit which generates a pattern-matching table in which instructions are listed starting with the highest appearance frequency in accordance with results counted by the instruction-counting unit; and

an interpreting unit which executes the control program while pattern-matching the instructions listed in the pattern-matching-table in order and interpreting the control program into codes directly-executable-~~execution codes~~ by the programmable controller.

24. (Amended) A control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, said control-program-development supporting apparatus comprising:

an instruction counting unit which counts the appearance frequency of each instruction used for the control program;

a pattern-matching-table generating unit which generates a pattern-matching table in which instructions are listed starting with the highest appearance frequency, in accordance with results counted by the instruction-counting unit; and

a compiler which compiles the control program into codes directly executable ~~codes~~ by the programmable controller while pattern-matching the instructions listed in the pattern matching table in order.

25. (Amended) A programmable controller that performs sequential processing in accordance with execution code s generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes;

a universal microprocessor-~~which mounts~~ including an acceleration-~~mounting~~ unit, such as a pipeline logic and a cache, and ~~which is directly-executed by~~ executing the execution codes; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, ~~which~~ the control-program-development supporting apparatus having a compiler which compiles the control program into codes directly executable by a

universal microprocessor that ~~mounts~~ includes an acceleration mounting unit, such as a pipeline logic and a cache.

26. (Amended) A programmable controller -that performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes;

a universal microprocessor which ~~mounts~~ includes an acceleration mounting unit, such as a pipeline logic and a cache, and ~~which is directly executed by~~ executing the execution codes; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language such as a ladder diagram or instruction list, ~~which the~~ the control-program-development supporting apparatus having,

a control-program dividing unit which divides the control program into a plurality of blocks; and

a compiler which compiles ~~all or~~ at least some of the blocks into execution codes directly executable by a programmable controller.

27. (Amended) A programmable controller that performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes;

a universal microprocessor which ~~mounts~~ includes an acceleration mounting unit, such as a pipeline logic and a cache, and ~~which is directly executed by~~ executing the execution codes; and

a control-program-development supporting apparatus that develops a control program, described with a sequential-control language such as a ladder diagram or instruction list, ~~which the~~ the control-program-development supporting apparatus having,

a control-program dividing unit which divides the control-program into a plurality of blocks;



a control-program converting unit which converts ~~all or~~ at least some of the blocks into advanced-language control programs described with a universal-computer-readable advanced language for every ~~blocks concerned~~ block; and

a compiler which compiles ~~all or~~ at least some of universal-computer-readable advanced programming languages corresponding to every ~~above~~ block into codes directly executable ~~codes~~ by a programmable controller.

28. (Amended) A programmable controller that performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes;

a universal microprocessor ~~which mounts~~ including an acceleration mounting unit, such as a pipeline logic and a cache, and ~~which is directly executed by~~ executing the execution codes; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, ~~which the~~ the control-program-development supporting apparatus having,

a control-program converting unit which converts the control program into an advanced-programming-language control program described with a universal-computer-readable advanced programming language;

a debugging-code generating unit which generates a debugging control program by inserting a line number ~~concerned~~ into a part corresponding to each line constituting the instruction list, in source codes constituting the advanced-programming-language control program; and

a debugging executing unit which displays each line of the instruction list and the execution part of the advanced-programming-language control program by relating the former with the latter.

29. (Amended) A programmable controller that performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes;

a universal microprocessor ~~which mounts~~ including an acceleration ~~mounting~~ unit, such as a pipeline logic and a cache, and ~~which is directly executed by~~ executing the execution codes; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language such as a ladder diagram or instruction list, ~~which~~ the control-program-development supporting apparatus having,

an instruction counting unit which counts the appearance frequency of each instruction used for the control program;

a pattern-matching-table generating unit which generates a pattern-matching table in which instructions are listed starting with the highest appearance frequency in accordance with results counted by the instruction-counting unit; and

a compiler which compiles the control program into codes directly executable ~~codes~~ by the programmable controller while pattern-matching the instructions listed in the pattern matching table in order.

30. (Amended) A programmable controller which performs sequential processing in accordance with execution codes generated by compiling a control program, comprising:

a first storing unit which stores the execution codes;

a second storing unit which stores the data for the difference between an execution code stored in the first storing unit and a new execution code;

a microprocessor ~~to be directly executed by~~ executing the execution codes;

a patch processing unit which changes an execution code currently executed to a new execution code at a predetermined timing in accordance with the difference data and continuously executing the changed execution code; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language, such as a ladder diagram or instruction list, ~~which~~ the control-program-development supporting apparatus having a compiler which compiles the control program into codes directly executable by a

universal microprocessor that ~~mounts~~ includes an acceleration-mounting unit, such as a pipeline logic and a cache.

31. (Amended) A programmable controller which performs sequential processing in accordance with execution codes generated by compiling a control program, said programmable controller comprising:

a storing unit which stores the execution codes; and

a microprocessor ~~to be directly-executed by~~ executing the execution codes,

wherein

the execution codes include binary data generated by compressing the control program; and

a control-program-development supporting apparatus that develops a control program described with a sequential-control language such as a ladder diagram or Instruction list, ~~which~~ the control-program-development supporting apparatus having a compiler which compiles the control program into codes directly executable by a universal microprocessor that ~~mounts~~ includes an acceleration-mounting unit, such as a pipeline logic and a cache.

32. (Amended) A programmable controller which performs sequential processing in accordance with a control program described with a sequential-control language, such as a ladder diagram or instruction list, said programmable controller comprising:

a storing unit which stores the control program;

an instruction counting unit which counts the appearance frequency of each instruction used for the control program;

a pattern-matching-table generating unit which generates a pattern-matching table in which instructions are listed starting with the highest appearance frequency in accordance with results counted by the instruction-counting unit;

an interpreting unit which executes the control program while pattern-matching the instructions listed in the pattern-matching table in order and interpreting the control program into codes ~~directly-executable-execution-codes~~ by the programmable controller; and